TOPOLOGY

VOLUME CONTENTS AND AUTHOR INDEX
VOLUME 37, 1998

PERGAMON

TOPOLOGY

An International Journal of Mathematics founded by J. H. C. Whitehead

Editors

Professor B. J. Birch
Professor S. K. Donaldson
Professor N. J. Hitchin
Professor I. M. James
Professor F. C. Kirwan
Professor D. Quillen
Dr J. Roe

The Mathematical Institute, 24–29 St. Giles,
Oxford OX1 3LB, England. *E-mail*: topology@maths.ox.ac.uk

Professor Ralph Cohen, Stanford University, Stanford, CA 94305, U.S.A.

Professor F. Hirzebruch, Max-Planck-Institut für Mathematik, Gottfried-Claren-Strasse 26, D 53225 Bonn, Germany

Professor Larry Siebenmann, Mathematique Bâtiment 425, Université Paris Sud, Centre D'Orsay, 91405 Orsay Cedex, France

Honorary Editorial Advisory Board

V. I. Arnol'd — R. Bott — H. Cartan
I. M. Gel'fand — B. Lawson — J. W. Milnor
G. B. Segal — J.-P. Serre

Author Service Department

For queries relating to the general submission of articles (including electronic text and artwork) and the status of accepted manuscripts, please contact the Author Service Department: e-mail: authors@elsevier.co.uk; fax: + 44 (0) 1865 843905; tel.: + 44 (0) 1865 843900.

Publishing Office

Elsevier Science Ltd, Bampfylde Street, Exeter EX1 2AH, UK.
[Phone (+1392) 251558; Fax (+1392) 425370]

Advertising Office

Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, UK.
[Phone (+1865) 843000; Fax (+1865) 843010]

Frequency: 6 issues per annum in January, March, May, July, September and November

Subscription Rates

Annual Institutional Subscription Rates 1998: Europe, The CIS and Japan NLG2127.00 Dutch Guilders. All other countries US$1223.00. Associated Personal Subscription rates are available on request for those whose institutions are library subscribers. Dutch Guilder prices exclude VAT. Non-VAT registered customers in the European Community will be charged the appropriate VAT in addition to the price listed. Prices include postage and insurance and are subject to change without notice. Any enquiry relating to subscriptions should be sent to: **The Americas:** Elsevier Science, Customer Support Department, P.O. Box 945, New York, NY 10010, U.S.A. [*Tel.*: (+1) 212-633-3730/1-888 4ES-INFO. *Fax*: (+1) 212-633-3680. *E-mail*: usinfo-f@elsevier.com]. **Japan:** Elsevier Science Customer Support Department, 9–15 Higashi-Azabu 1-chome, Building 4F, 1-9-5 Higashi Azabu, Minato-ku, Tokyo 106, Japan [*Tel.*: (+ 81) 3-5561-5033. *Fax* (+ 81) 3-5561-5047. *E-mail*: info@elsevier.co.jp]. **Asia Pacific (*excluding Japan*)**: Elsevier Science (Singapore) Pte Ltd, No. 1 Temasek Avenue, 17-01 Millenia Tower, Singapore 039192 [*Tel.*: (+ 65) 434-3727. *Fax*: (+ 65) 337-2230. *E-mail*: asiainfo@elsevier.com.sg]. **Rest of the World:** Elsevier Science Customer Service Department, P.O. Box 211, 1001 AE Amsterdam, The Netherlands [*Tel.*: (+ 31) 20-485-3757. *Fax*: (+ 31) 20-485-3432. *E-mail*: nlinfo-f@elsevier.nl].

Back issues

Back issues of all previously published volumes are available direct from Elsevier Science Offices (Oxford and New York). Complete volumes and single issues can be purchased for 1993–1997. Earlier issues are available in high quality photo-duplicated copies as complete volumes only. Back volumes on microfilm are available from UMI, 300 North Zeeb Road, Ann Arbor, MI 48106, U.S.A.

© *1998 Elsevier Science Ltd. All rights reserved*

PERIODICALS POSTAGE PAID AT RAHWAY, NJ. *Topology* (ISSN 0040-9383) is published 6 issues per annum by Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, U.K. The annual subscription in the U.S.A. is $1223.00. *Topology* is distributed by Mercury Airfreight International Ltd, 365 Blair Road, Avenel, NJ 07001, U.S.A. Postmaster: Please send address corrections to *Topology*, c/o Elsevier Science Regional Sales Office, Customer Support Department, 655 Avenue of the Americas, New York, NY 10010, U.S.A.

PII: S0040-9383(98)00025-1

CONTENTS

NUMBER 1

JUHA HEINONEN and SEPPO RICKMAN: Quasiregular maps $S^3 \to S^3$ with wild branch sets 1

CHRISTINE LESCOP: On the kernel of the Casson invariant 25

PENG CHIAKUEI and TANG ZIZHOU: Harmonic maps from spheres to spheres 39

K. BEKKA and S. KOIKE: The Kuo condition, an inequality of Thom's type and (C)-regularity 45

MARC LACKENBY: Upper bounds in the theory of unknotting operations 63

N. HABEGGER and U. KAISER: Link homotopy in the 2-metastable range 75

YING-QING WU: Dehn fillings producing reducible manifolds and toroidal manifolds 95

VINCENT FRANJOU and TEIMURAZ PIRASHVILI: On the MacLane cohomology for the ring of integers 109

JONATHAN WEITSMAN: Geometry of the intersection ring of the moduli space of flat connections and the conjectures of Newstead and Witten 115

BENEDICT FREEDMAN and MICHAEL H. FREEDMAN: Kneser–Haken finiteness for bounded 3-manifolds, locally free groups, and cyclic covers 133

JÜRGEN ROHLFS and JOACHIM SCHWERMER: An arithmetic formula for a topological invariant of Siegel modular varieties 149

MIKIYA MASUDA, LUCY MOSER-JAUSLIN and TED PETRIE: Invariants of equivariant algebraic vector bundles and inequalities for dominant weights 161

TERUHIKO SOMA: Existence of non-Banach bounded cohomology 179

EUGENII SHUSTIN: Gluing of singular and critical points 195

STAVROS GAROUFALIDIS: Applications of quantum invariants in low dimensional topology 219

ERRATUM 225

NUMBER 2

STAVROS GAROUFALIDIS and TOMOTADA OHTSUKI: On finite type 3-manifold invariants III: manifold weight systems 227

EUGENE LERMAN, ECKHARD MEINRENKEN, SUE TOLMAN and CHRIS WOODWARD: Non-Abelian convexity by symplectic cuts 245

A. CIMA, F. MAÑOSAS and J. VILLADELPRAT: A Poincaré–Hopf theorem for non-compact manifolds 261

J. P. C. Greenlees and Hal Sadofsky: Tate cohomology of theories with one-dimensional coefficient ring 279

Donald M. Davis: Elements of large order in $\pi_*(SU(n))$ 293

Michael Slack: Infinite loop spaces with odd torsion-free homology 329

J. Daniel Christensen and Neil P. Strickland: Phantom maps and homology theories 339

Joan Porti: Regenerating hyperbolic and spherical cone structures from Euclidean ones 365

Michel Coste and Krzysztof Kurdyka: Le discriminant d'un morphisme de variétés algébriques réelles 393

William Chen: Counterexamples to Knaster's conjecture 401

A. D. King and P. E. Newstead: On the cohomology ring of the moduli space of rank 2 vector bundles on a curve 407

Thomas F. Banchoff and Ockle Johnson: The Normal Euler Class and singularities of projections for polyhedral surfaces in 4-space 419

Ka Yi Ng: Groups of ribbon knots 441

Corrigendum 459

NUMBER 3

Žarko Bižaca and John Etnyre: Smooth structures on collarable ends of 4-manifolds 461

Michael Farber, Gabriel Katz and Jerome Levine: Morse theory of harmonic forms 469

Curtis T. McMullen: Kleinian groups and John domains 485

T. D. Cochran and Kent E. Orr: Stability of lower central series of compact 3-manifold groups 497

Mahan Mitra: Cannon–Thurston maps for hyperbolic group extensions 527

Thang T. Q. Le, Jun Murakami and Tomotada Ohtsuki: On a universal perturbative invariant of 3-manifolds 539

Bang-He Li and Tian-Jun Li: Minimal genus smooth embeddings in $S^2 \times S^2$ and $CP^2 \# n\overline{CP}^2$ with $n \leqslant 8$ 575

M. N. Goussarov: Interdependent modifications of links and invariants of finite degree 595

V. Goryunov: Vassiliev type invariants in Arnold's J^+-theory of plane curves without direct self-tangencies 603

G. A. Niblo and L. D. Reeves: The geometry of cube complexes and the complexity of their fundamental groups 621

EMILY HAMILTON: Geometrical finiteness for hyperbolic orbifolds 635

N. I. SHEPHERD-BARRON: Semi-stability and reduction mod p 659

MARK BRITTENHAM: Exceptional Seifert-fibered spaces and Dehn surgery on 2-bridge knots 665

EFSTRATIA KALFAGIANNI: Finite type invariants for knots in 3-manifolds 673

NUMBER 4

CARLES CASACUBERTA and JOSÉ L. RODRÍGUEZ: On weak homotopy equivalences between mapping spaces 709

RUTH KELLERHALS: Volumes of cusped hyperbolic manifolds 719

I. MOERDIJK: Proof of a conjecture of A. Haefliger 735

OCTAVIAN CORNEA, YVES FÉLIX and JEAN-MICHEL LEMAIRE: Rational category and cone length of Poincaré complexes 743

YVES FÉLIX, STEVE HALPERIN and JEAN-MICHEL LEMAIRE: The rational LS category of products and of Poincaré duality complexes 749

N. P. STRICKLAND: Morava E-theory of symmetric groups 757

INDRANIL BISWAS and D. S. NAGARAJ: Parabolic ample bundles, II: Connectivity of zero locus of a class of sections 781

A. N. DRANISHNIKOV, J. KEESLING and V. V. USPENSKIJ: On the Higson corona of uniformly contractible spaces 791

MARC CULLER, SA'AR HERSONSKY and PETER B. SHALEN: The first Betti number of the smallest closed hyperbolic 3-manifold 805

HERMAN GLUCK and LIU-HUA PAN: Embedding and knotting of positive curvature surfaces in 3-space 851

SERGIO R. FENLEY: Limit sets of foliations in hyperbolic 3-manifolds 875

JAMES F. DAVIS: The rational symmetric signature of manifolds with finite fundamental group 895

STAVROS TSALIDIS: Topological Hochschild homology and the homotopy descent problem 913

NUMBER 5

ANTJE CHRISTENSEN: A Gordon–Luecke-type argument for knots in lens spaces.. 935

ROBIN FORMAN: Witten–Morse theory for cell complexes 945

AMNON NEEMAN: Non-compactly generated categories 981

MICHAEL POLYAK: Invariants of curves and fronts via Gauss diagrams 989

JIE WU: On combinatorial calculations for the James–Hopf maps 1011

JIE WU: A product decomposition of $\Omega_0^3 \Sigma \mathbf{R}P^2$ 1025

S. M. GERSTEN: Cohomological lower bounds for isoperimetric functions on groups 1031

C. W. STARK: Approximate finiteness properties of infinite groups 1073

YOAV MORIAH and JENNIFER SCHULTENS: Irreducible Heegaard splittings of Seifert fibered spaces are either vertical or horizontal 1089

JIE WU: On fibrewise simplicial monoids and Milnor–Carlsson's constructions 1113

NUMBER 6

MICHEL JAMBU and STEFAN PAPADIMA: A generalization of fiber-type arrangements and a new deformation method 1135

THOMAS SCHICK: A counterexample to the (unstable) Gromov–Lawson–Rosenberg conjecture 1165

BENSON FARB and HOWARD MASUR: Superrigidity and mapping class groups..... 1169

R. RIMÁNYI and A. SZŰCS: Pontrjagin–Thom-type construction for maps with singularities 1177

MICHAEL KAPOVICH, BRUCE KLEINER and BERNHARD LEEB: Quasi-isometries and the de Rham decomposition 1193

ROBERTO SILVOTTI: A factorization property of cohomology of the complement of a braid-type arrangement 1213

MARCO BRUNELLA: Sur les courbes intégrales propres des champs de vecteurs polynomiaux 1229

LUDWIG BALKE, ALEXANDRA KAESS, UTA NEUSCHÄFER, FRANK ROTHENHÄUSLER and STEFAN SCHEIDT: Polyhedral fundamental domains for discrete subgroups of PSL (2, $\mathbb{R}$)..... 1247

CHRISTOPHER B. CROKE and VLADIMIR A. SHARAFUTDINOV: Spectral rigidity of a compact negatively curved manifold 1265

B. H. BOWDITCH: Group actions on trees and dendrons..... 1275

ANDRZEJ SZYMCZAK: A cup product pairing and time-duality for discrete dynamical systems 1299

J. P. C. GREENLEES: Augmentation ideals of equivariant cohomology rings..... 1313

STEVEN C. FERRY: Limits of polyhedra in Gromov–Hausdorff space 1325

ALAN H. DURFEE: The index of *grad* $f(x, y)$ 1339

PASCAL LAMBRECHTS: Analytic properties of Poincaré series of spaces..... 1363

V. GORBOUNOV, M. MAHOWALD and P. SYMONDS: Infinite subgroups of the Morava stabilizer groups 1371